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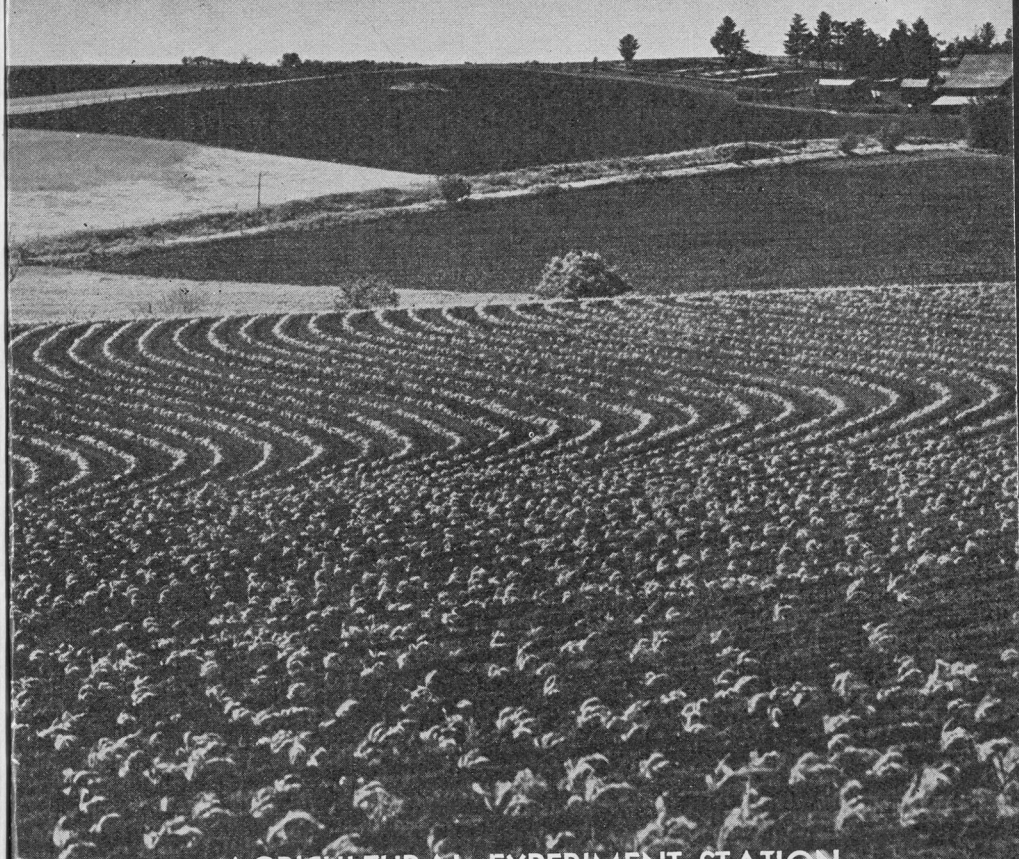
The Farmer Looks at Soil Conservation In Southern Iowa



AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS
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SUMMARY

1. Over 90 percent of the farmers cooperating with the Soil Conservation Service who were interviewed in this study reported that the program had reduced sheet and gully erosion; 55 percent stated that sheet erosion had been greatly reduced or stopped, while almost 70 percent reported that gully erosion had been greatly reduced or stopped.

2. Fifty-five percent of the farmers stated that the productivity of their farms had already been increased by the Soil Conservation Service program, while 95 percent expected an increased productivity in the future.

3. Practically all farmers stated that the program had increased the value of their farms, and the average increase reported was $5.44 per acre.

4. According to farmers' reports, labor requirements were unaffected on over half the farms by terracing, strip cropping or contouring; more farmers reported an increase in labor requirements on terraced fields than on strip cropped or contoured fields.

5. On strip cropped and contoured fields reports show a decrease in tractor fuel requirements; similarly, contouring made work easier for horses.

6. In general, the practices and structures introduced on the farms have met the expectations of the farmers and, except where large financial outlays are involved or specialized technical knowledge required, these would be continued even though assistance were withdrawn.

7. While practically all the farmers believed that the AAA program alone was insufficient to control erosion in their area, they stated that the adjustment payments had been important in helping them follow the plan.

8. Under the Soil Conservation Service program permanent pasture is to be increased on cooperating farms by about 10 percent in the Western Livestock and South Central Pasture

areas and by 23 percent in the Southern Pasture Area; intertilled crops are to be reduced 20 to 40 percent and total meadow land increased 10 to 60 percent from the previous acreage, with wide variations in the changes between different type-of-farming areas.

9. In the areas where erosion has been most severe, more drastic changes in land use have been planned, more dams have been erected, and a larger acreage per farm has been terraced.

10. The increase in roughage resulting from the Soil Conservation Service program will be used to reduce present overgrazing of permanent pasture or plowed under as green manure or used by carrying additional numbers of roughage-consuming animals.

11. There is no indication that the reduction in acreages of intertilled crops has resulted in a decrease in the number of concentrate-consuming animals fed on the farms. Farmers indicated that they expected to increase the numbers of hogs fed as well as the number of roughage-consuming animals. On individual farms the numbers of concentrate-consuming animals fed is not related to the percentage of the land in intertilled crops but is rather closely related to the amount of feed bought or sold.

12. The question of whether or not soil conservation will pay is one which must be answered individually by each farm owner and involves a consideration of the capital loss resulting from continued erosion, an estimate of direct capital costs of control measures and the change in income resulting from the internal reorganization of the farm enterprise. Under the latter, consideration must be given to changes in labor requirements, shifts in the production of grains and roughage feed units and means of utilizing the larger quantities of roughage.

The Farmer Looks at Soil Conservation in Southern Iowa[1]

By Arthur C. Bunce[2]

In the south and southwest areas of Iowa, 2,190 farmers operating over 348,612 acres were cooperating with the Soil Conservation Service in June, 1938, in an attempt to control erosion on their farms.

A further extension of soil conservation is being considered through the development of soil conservation districts under a state Soil Conservation Districts Law. The formation of such districts will raise the following specific questions.

1. What do farmers at present cooperating with the Soil Conservation Program think of it and of specific elements in it?
2. How serious is erosion in these areas where soil conservation has been introduced compared to the area under consideration?
3. What does soil conservation involve in changed cropping systems and farming practices, and what have farmers agreed to do on their farms in cooperation with the Soil Conservation Service?
4. What has been the effect of these changes upon the livestock system?
5. Finally, how can it be determined whether it will really pay to adopt certain changes in land use and farming practices on the individual farm?

During 1937 a survey was made in order to obtain information which would throw some light on these questions. This

[1] Project 578 of the Iowa Agricultural Experiment Station. The Bureau of Agricultural Economics of the United States Department of Agriculture is cooperating in the project, but it is not responsible for any part of this publication, although its representatives, particularly Sherman E. Johnson and Neil W. Johnson of the Division of Farm Management and Costs, have contributed valuable suggestions. A research bulletin on this subject will follow.

[2] The author wishes to express his indebtedness to the many workers in the Operations Division of the Soil Conservation Service in Region 5, whose cooperation made this study possible, to Orin J. Reusser and John H. Dickerson, research assistants, who assisted in preparing and analyzing the material, and to Ethelyn Downing, who was mainly responsible for the tabulation of the study.

bulletin presents the results in five sections corresponding to the questions listed above.[3]

FARMERS' OPINIONS OF SOIL CONSERVATION AS INTRODUCED BY THE SOIL CONSERVATION SERVICE

That there is a pressing problem of soil conservation in many areas of the country has been recognized for some time, but concerted action as an approach to control is new. Indeed, it is so new that an exact quantitative analysis of the effects of the program is practically impossible. Because of this fact, it was deemed desirable to obtain the reactions of cooperating farmers regarding the effectiveness and desirability of the program, as their close observations of the first effects enable them to appraise the program and practices of the Soil Conservation Service on their farms more accurately than could any other group.[4] As the primary purpose of this study was to obtain farmers' opinions, these are presented in the first section of the bulletin.

Data showing the seriousness of erosion in the area, the changes in farming practices and land use upon which these opinions are based and the effect of these changes upon the livestock system and the farmers' income are presented in subsequent sections.

EFFECTIVENESS OF THE PROGRAM

To judge the results of any program the first question that must be asked is, "How effective has it been in reaching its

[3] Because of the newness of the program it is impossible to present a picture of the final results; that can be done only after a longer period of time when all the changes planned have been in force long enough for the farmer to adjust his enterprise to the completed program. This bulletin necessarily can present only a picture of what the results of the program in its present developments are and what benefits and problems the farmers feel have resulted from the program up to the present. While not being conclusive, the bulletin provides material which may help an individual farmer or a group of farmers to understand the problems of erosion control on the individual farm and for an area as a whole, how the problem has been attacked and the factors which must be considered when making an evaluation of the economic effects of soil conservation.

The material upon which the study is based was obtained on schedules filled in by an enumerator in consultation with the farmer and from farm records kept in cooperation with the Extension Service of Iowa State College.

[4] The opinions presented here may be somewhat biased by the fact that the farmer is in the program and tends to rationalize his participation. Also the fact that the program has been in operation for only a few years and the possibility that these opinions may undergo some modifications during the next few years, must be kept in mind.

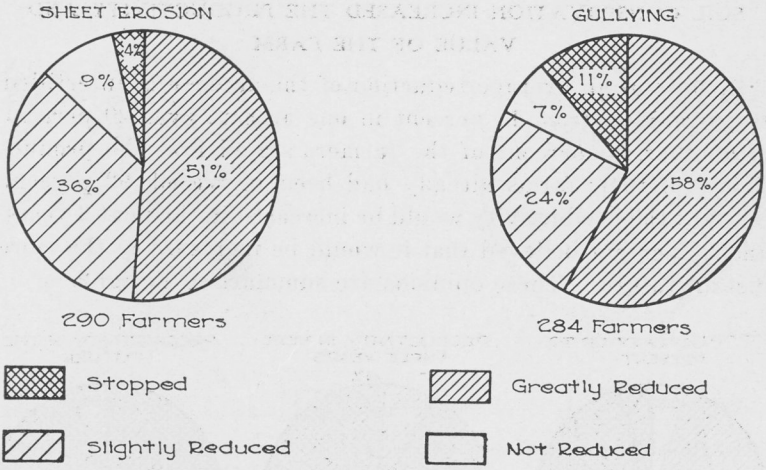

Fig. 1. Opinions of farmers regarding the effect of the Soil Conservation Service program upon erosion.

goal?'' In this case we want to know whether the changes in land use and systems of crop rotation, the building of dams and terraces and the use of strip cropping and contour farming have controlled erosion on the farms in question. To measure this physically is extremely difficult because there are no records of the rate at which erosion was taking place before the program was adopted nor do we have accurate measurements of the rate at which erosion is continuing after the new system has been established. In this case the farmer, who knew the conditions which existed prior to his adoption of a soil conserving system of farming, probably can best judge the effectiveness of the program. The opinions of farmers regarding the effect of the soil conservation program upon sheet and gully erosion are presented in fig. 1.

Few of the farmers reported that erosion had been stopped. Under conditions where intense rainfall is common, some washing of the soil is bound to take place unless the land is covered by a dense sod. Over 90 percent reported a decrease in sheet erosion, and over 92 percent a decrease in gullying. Since both sheet erosion and gullying have already been materially reduced on the majority of farms using soil conserving methods, the question was asked, ''Has the control of erosion affected the productivity of the farm?''

SOIL CONSERVATION INCREASED THE PRODUCTIVITY AND VALUE OF THE FARM

In spite of an average reduction of the acreage of intertilled crops ranging from 12 percent in one area to over 20 percent in another, 55 percent of the farmers stated that the productivity[5] of their farms already had been increased, 92 percent felt that the productivity would be increased in the next 3 years, and 95 percent believed that it would be increased in the more distant future.[6] These opinions are summarized in fig. 2.

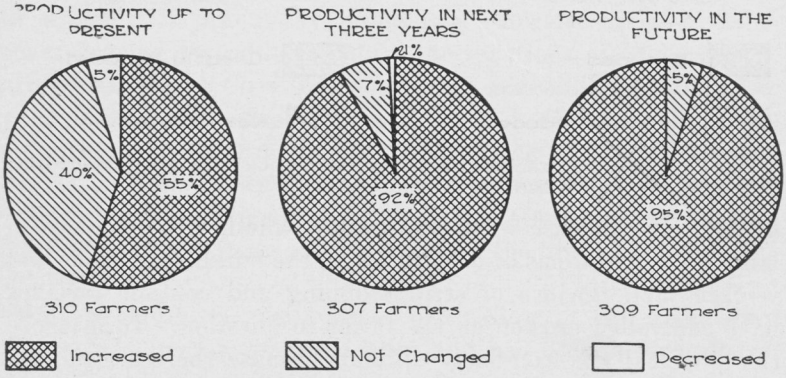

Fig. 2. Opinions of farmers regarding the effect of the Soil Conservation Service program upon the productivity of their farms.

When asked whether the program had increased the value of their farms, 248 farmers stated that it had, 34 stated it had not, and 38 gave no answer. The average increase in value was $5.44 per acre according to the estimates made by 172 of the farmers who reported an increase.

EFFECT OF TERRACING, STRIP CROPPING AND CONTOUR FARMING UPON LABOR AND FUEL REQUIREMENTS

The measurement of changes in labor and fuel required for working terraced or contoured fields, when compared with the same fields worked in straight rows, is almost as difficult as measuring the changes in the speed of erosion. Until carefully controlled studies can be made, estimates of farmers again appear to be the best approach to an appraisal. Figures 3 and 4

[5] This refers to the total physical productivity of the farm. The fact that the SCS has assisted farmers to obtain lime, fertilizer and grass or legume seed should be considered in interpreting these opinions.

[6] For a complete analysis of the changes in land use see page 142 and tables 1 and 2 in the appendix.

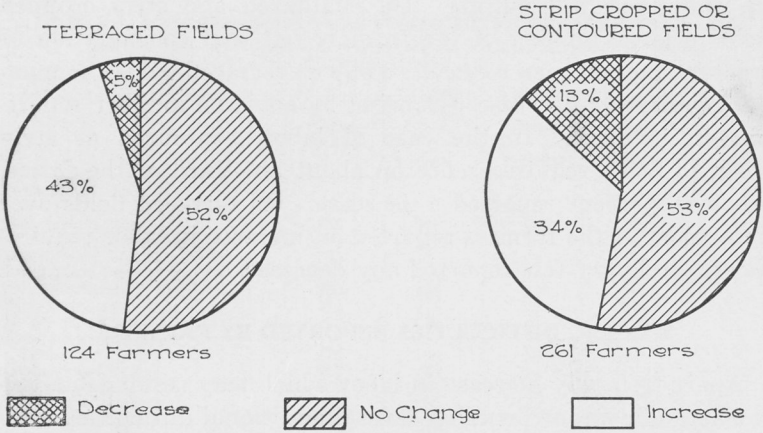

Fig. 3. Opinions of farmers regarding the comparative labor requirements on terraced, strip cropped and contoured fields.

present the opinions of farmers regarding comparative labor and fuel requirements before and after the program was adopted.

Regarding the effect of contour cultivation on horse labor, 92 percent of 197 farmers reported that farming on the contour made work easier for the horses, and 84 percent stated that this more than offset any extra time used.

In general, these replies indicate that where horses are used there may have been some increase in the time required to work fields on the contour, but this was offset by the elimination of

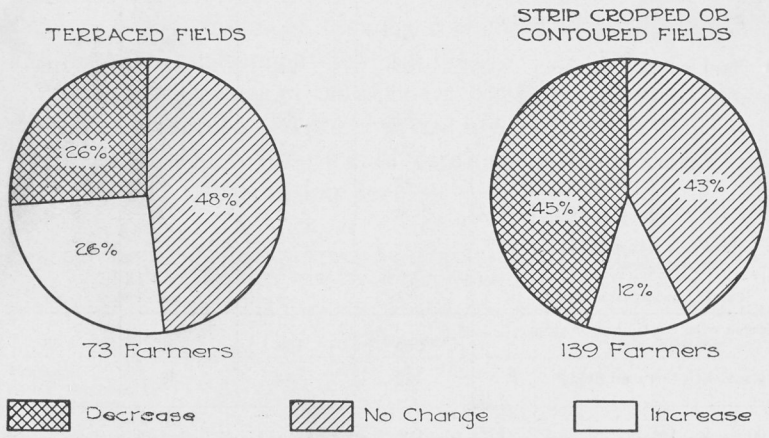

Fig. 4. Opinions of farmers regarding the comparative fuel requirements on terraced, strip cropped and contoured fields.

up and down hill pulling. On contoured and strip cropped fields a large number of the farmers felt that consumption of tractor fuel had been reduced; while on terraced fields the number reporting a decrease was offset by an equal number reporting an increase. In the case of labor, contoured or strip cropped fields required more on about one-third of the farms, while 10 percent reported a decrease. On terraced fields over 40 percent of the farmers reported an increase in labor requirements, and very few reported any decrease.

SPECIFIC DIFFICULTIES REPORTED BY FARMERS

Apart from any increase in labor which may result from terracing and contour farming, several additional difficulties were reported. These are listed in table 1 and classified by type-of-farming area because of the wide variation in answers.

The two major difficulties encountered were weed control

TABLE 1. SPECIFIC DIFFICULTIES REPORTED BY FARMERS WITH TERRACED, CONTOURED OR STRIP CROPPED FIELDS IN THREE TYPE-OF-FARMING AREAS, IOWA, 1937.

Difficulties reported	Areas			
	Total	Western livestock	S. Central pasture	Southern pasture
	Number of farmers reporting			
1. Hard to control weeds on corn not check rowed	72	25	27	20
2. Hard to turn in fields without destroying crops	63	42	13	8
3. Hard to follow contours	42	24	8	10
4. Hard to reach fields without crossing others	33	20	8	5
5. Too many short rows	20	15	3	2
6. Hard to farm terraces	12	2	3	7
7. Hard to fence on contoured land	6	3	3	—
8. Hard to pasture strip cropped fields	1	1	—	—
9. Insect hazards increased	1	—	1	—
Farms with contoured or strip cropped fields	255	156	51	48
Farms with terraced fields*	129	54	36	39

*All terraced fields are also contour farmed or strip cropped and included in these totals. See tables 3, 4 and 5 in the appendix for complete details.

TABLE 2. FARMERS' REPLIES AS TO WHETHER THE STRUCTURES AND PRACTICES INTRODUCED HAD MET THEIR EXPECTATIONS, SOUTHERN IOWA, 1937.

	Total replies	Expectations met			
		Yes	Percent	No	Percent
Practices and structures					
Rotation of crops	276	266	96	10	4
Adding crop residues	228	218	96	10	4
Use of cover crops	125	122	98	3	2
Liming and fertilizing	244	220	90	24	10
Contour farming	200	184	92	16	8
Strip cropping	111	79	71	32	29
Buffer strips	68	31	46	37	54
Retiring cropland to permanent pasture	171	142	83	29	17
Grassed waterways	257	234	91	23	9
Tree plantings	109	103	95	6	5
Sloping gully banks	139	138	99	1	1
Dams (temporary)	246	226	91	20	8
Dams (permanent)	142	138	97	4	3
Terraces (level)	57	57	100	0	0
Terraces (draining)	111	108	97	3	3
Contour furrows	67	66	98	1	2

and turning in the fields. In the two pasture areas about half of the farmers with contoured or strip cropped fields reported difficulty in controlling weeds when the corn was not check rowed; in the Western Livestock Area the percentage of farmers facing this difficulty was much smaller.

HAVE THE FARMERS BEEN SATISFIED WITH THE PROGRAM?

In spite of these difficulties the practices and structures introduced on the farms met the expectations of most of the farmers. The replies of farmers regarding specific structures and practices are summarized in table 2.

Further indications of the farmers' appraisal of specific practices and structures on their farms are the replies they gave when asked which they would continue to use without help from the Soil Conservation Service.

TABLE 3 NUMBERS OF FARMERS WHO WOULD AND WOULD NOT ERECT SPECIFIC STRUCTURES IF HELP WERE NOT AVAILABLE.

Structures	Would erect	Would not erect
Terraces	29	103
Dams (temporary)	174	24
Dams (permanent)	31	130
Diversion ditches	9	11
Contour furrows	32	46

TABLE 4. REASONS WHY FARMERS WOULD NOT ERECT STRUCTURES WITHOUT HELP.

Reasons	Number of farmers	Percent
1. Lack of finances	117	46
2. Lack of information (did not know how)	56	21
3. Lack of time	27	10
4. Lack of equipment	24	9
5. Structure not satisfactory	15	6
6. Other	24	9
Total giving reasons	263	100

Most of the farmers would not put in terraces, permanent dams or contour furrows unless help were available, as is shown in table 3, and the reasons advanced are presented in table 4 in order of their importance as determined by the number of farmers listing each.

The most important resistance to the erection of structures, without Soil Conservation Service help, appears to be financial. Lack of time, information and equipment can be remedied by hiring labor, technicians and machinery. When added together these amount to 85 percent of all the reasons. Dissatisfaction with the structures was listed in only 6 percent of the cases as a reason for the farmers' unwillingness to erect them if no SCS help was available.

Regarding tillage practices of various kinds we find much more willingness by farmers to continue them without financial help. Table 5 gives the more important practices which would be discontinued if no help was available. It is important to note that none of the farmers would discontinue their rotation of crops, the returning of crop residues or use of cover crops.

The sloping of gully banks, grassing waterways and tree plantings could be classed with structures in that they are

TABLE 5. PRACTICES FARMERS WOULD DISCONTINUE IF HELP WERE NOT AVAILABLE.

Practice	Number of farmers using practice	Farmers who would discontinue practice	
		Number	Percent
Stripcropping	84	23	27
Sloping gully banks	108	24	22
Contour farming	171	26	15
Liming and fertilizing	239	21	9
Grassing waterways	226	10	4
Tree plantings	166	10	6

TABLE 6. REASONS WHY FARMERS WOULD DISCONTINUE THE PRACTICES LISTED IN TABLE 5.

Reasons	Number of farmers	Percent
Lack of finances	31	37
Too much labor involved	24	28
Lack of knowledge or skill	13	15
No need to continue	10	12
Other	7	8
Total giving reasons	85	100

operations requiring much labor or large machinery and are not repeated each year; these would not be expanded. In the case of contour farming and strip cropping (including buffer strips) a significant number of the farmers stated that they would not continue these annual practices without help; the reasons why they would not continue are listed in table 6.

The reasons for discontinuing some practices are again largely financial and this raises the question of whether demonstrations alone could achieve erosion control in these cases. In the case of contour or strip crop farming the difficulty of laying out contour lines was specifically mentioned. Only two farmers were dissatisfied with the results of the practices.

THE AAA PAYMENTS IN RELATIONSHIP TO COOPERATION WITH THE SOIL CONSERVATION SERVICE

Where there are two farm programs working on the same farm it is an almost impossible task to separate their respective results. Two hundred and eighty-one (88 percent) of the 321 farmers included in the sample and cooperating with the SCS were also cooperating with the AAA in 1934, 287 (89 percent) in 1935, 296 (92 percent) in 1936 and 269 (84 percent) in 1937. This immediately raises the question as to how important were the AAA benefit payments in helping the farmer carry out an agreement with the SCS. To answer this question objectively appears impossible and again the only measure we have is the opinions of the farmers. One hundred and eight farmers (42 percent) stated that the AAA payments were very important in helping them follow the SCS plan, 102 (39 percent) said they were important and 50 (19 percent) felt they were not important. When asked whether they could have cooperated with

the SCS without the assistance of AAA payments, 230 (76 percent) stated that they could, and only 71 (24 percent) stated that they could not. When asked whether they could continue to cooperate with the SCS without AAA assistance 231 (80 percent) stated that they could and 56 (20 percent) stated that they could not.

Regarding any conflicts between the two programs, 226 farmers (92 percent) stated that there was no conflict, and only 21 (8 percent) reported a conflict in acreages.

A still more difficult problem of appraisal arises when an attempt is made to evaluate the effectiveness of each program from the standpoint of controlling soil erosion. Where the two programs are acting on the same farm it is impossible to separate them accurately. The farmers, however, know the details of both programs as they operate on their farms and are able to pass some judgment. To obtain some indication of this the farmers were asked if they felt that the AAA or SCS alone was sufficient to control erosion in the demonstration areas and to state the reasons for their judgments. The results of these questions are presented in tables 7 and 8.

TABLE 7. FARMERS' OPINIONS OF ABILITY OF AAA OR SCS PROGRAM ALONE TO CONTROL EROSION.

Question	Farmers replies	
	Yes	No
Is AAA alone sufficient to control erosion in your area?	9	301
Is SCS alone sufficient to control erosion in your area?	191	115

These replies reveal that the farmers in these areas do not believe the AAA program alone can control erosion. On the other hand, the majority felt that the SCS program alone was sufficient. Those who stated that the SCS program alone was not sufficient felt that it was not complete and did not give financial aid. In short, it was held that, purely from an erosion control standpoint, the AAA was incomplete while the SCS program did not give enough financial assistance. Two hundred and twenty farmers believed that the two programs should be

TABLE 8. REASONS WHY THE AAA OR SCS PROGRAM ALONE IS OR IS NOT SUFFICIENT TO CONTROL EROSION.

Reasons*	Number of farmers stating each reason
Why the AAA program is not sufficient	
1. Is not complete enough	181
2. Has no bearing on erosion control	51
3. Is only production control	15
4. Is not based upon sound land use	12
Why the SCS program is not sufficient	
1. Is not complete	57
2. Does not give financial help	31
3. Does not reach enough people	3
Why the SCS program is sufficient	
1. Is a practical program	119
2. Is a complete program	37
3. Men are trained in erosion control	13

*These reasons were given in the farmers' own words and the interviewers were instructed not to suggest reasons nor to discuss the spontaneous replies of the farmer. There is, therefore, some doubt as to the exact meaning implied in the replies. It is the author's opinion that the phrase "not complete" in reference to the AAA means that the program lacks such things as strip cropping, terraces, dams, etc., the same phrase applied to the SCS program may mean several alternatives: 1. That there was not a complete sign-up of all farmers in a watershed; 2. that the watersheds and CCC camp areas covered only a small fraction of the area needing erosion control; 3. that financial aid was not provided, and 4. that more work needed to be done on their farm to control erosion.

combined, while 79 thought that they should not.[7] In the past these two programs appear to have been complementary, with each making up deficiencies in the other.

In summarizing these farmers' opinions of the work done on their farms in cooperation with SCS, it appears that the program has been effective in reducing erosion, that it has not materially reduced the productivity of the farm up to the present and may increase it in the future, that labor requirements on terraced fields have been somewhat increased, that the AAA payments were important in assisting the farmer to adopt the SCS program and that the rotations and practices introduced would be maintained without continued assistance from the SCS except in the case of practices involving technical skills, large amounts of labor or large expenditures of money in order to continue them.

[7] In interpreting these answers the fact should be kept in mind that the SCS program is exclusively directed at erosion control and involves intensive cooperation of specialized technicians with each individual farmer in relatively restricted areas, while the AAA program, formerly set up for production control over the entire country, is aimed now at income parity through the use of conservation measures. In no case can the answers be interpreted as a criticism of the AAA program. They merely indicate that the majority of farmers with experience in both programs feel that the individual farm approach of the SCS results in a more effective attack on the erosion problem on any given farm.

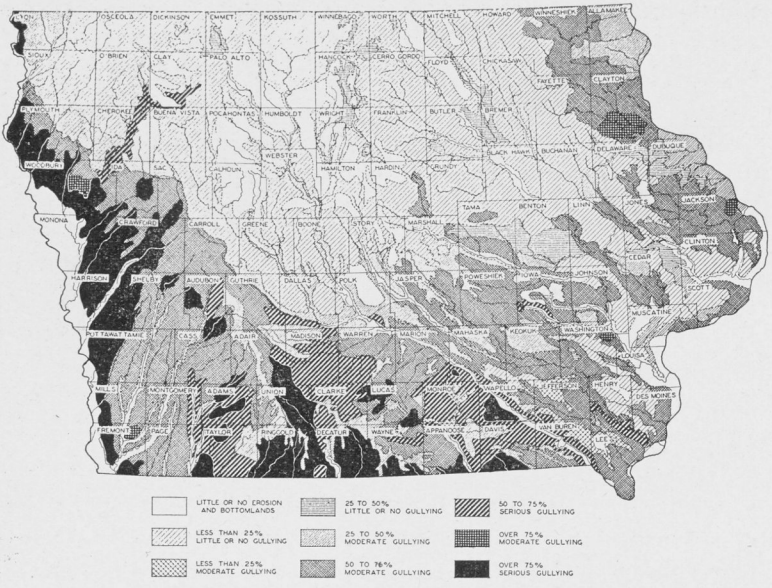

Fig. 5. Extent and seriousness of soil erosion in Iowa.

THE SERIOUSNESS OF EROSION IN THE AREA STUDIED

The seriousness of erosion in the areas studied is revealed in fig. 5. The location of the farms included in this study is shown in fig. 6.

In the area studied a large part of the land has lost from 50 to 75 percent of the topsoil and gullying is moderate to serious. Figure 7 shows a profile of virgin soil compared with a soil profile of the same soil type from a nearby cultivated area and illustrates how great have been the soil losses on some cultivated fields.

Since the greater part of the area under consideration had less than two persons per square mile in 1850, the short period of time that most of the land has been cultivated is evident. Yet a large amount of the topsoil in some areas has been lost. During the early years these losses may not seem so important but, as the depth of the remaining surface soil is reduced, further losses take place more rapidly and become more and more serious. On many slopes the appearance of the lighter

colored subsoils indicates that the topsoil has all been removed. These soil losses have been due largely to the removal of the native vegetation which protected and held the surface soil in place. The rapidity with which erosion takes place when the land is once cultivated depends upon the soil type, the topography of the land, the intensity and distribution of the rainfall, the system of land use, the cover and practices followed. In these areas the annual precipitation runs from 30 to 34 inches; rains of high intensity are common and are one of the important factors contributing to rapid erosion. Figures 8 and 9 show examples of sheet erosion that takes place on bare fields or on fields planted in rows which run up and down the hills. Figure 10 shows gullying as it often occurs on the soils typical of the area included in this study.

Farmers have recognized the menace of erosion for many years. Out of 309 farmers cooperating with the SCS, 53 percent stated that they had noticed erosion on their farms over 15 years ago, 27 percent had noticed it 6 to 15 years ago, and only 20 percent had noticed it less than 5 years ago. Of a comparable group of farmers not cooperating with the SCS, 47 percent stated that they had noticed erosion on their farms over 15 years ago. Not only had these farmers noticed erosion

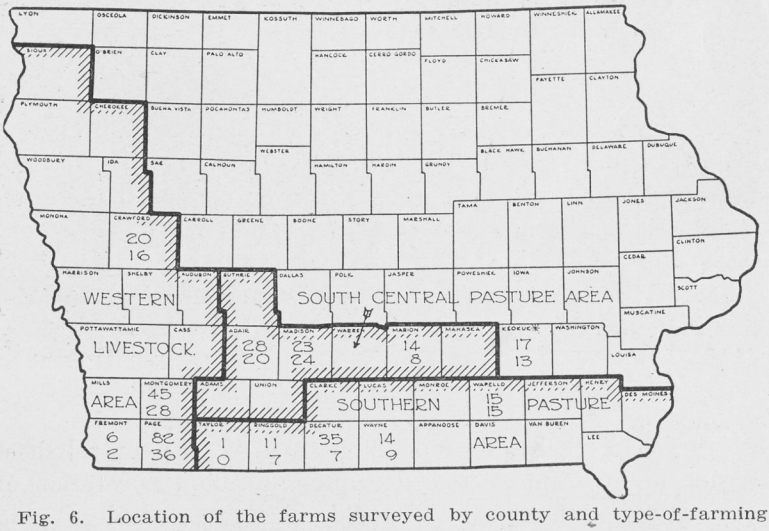

Fig. 6. Location of the farms surveyed by county and type-of-farming area.

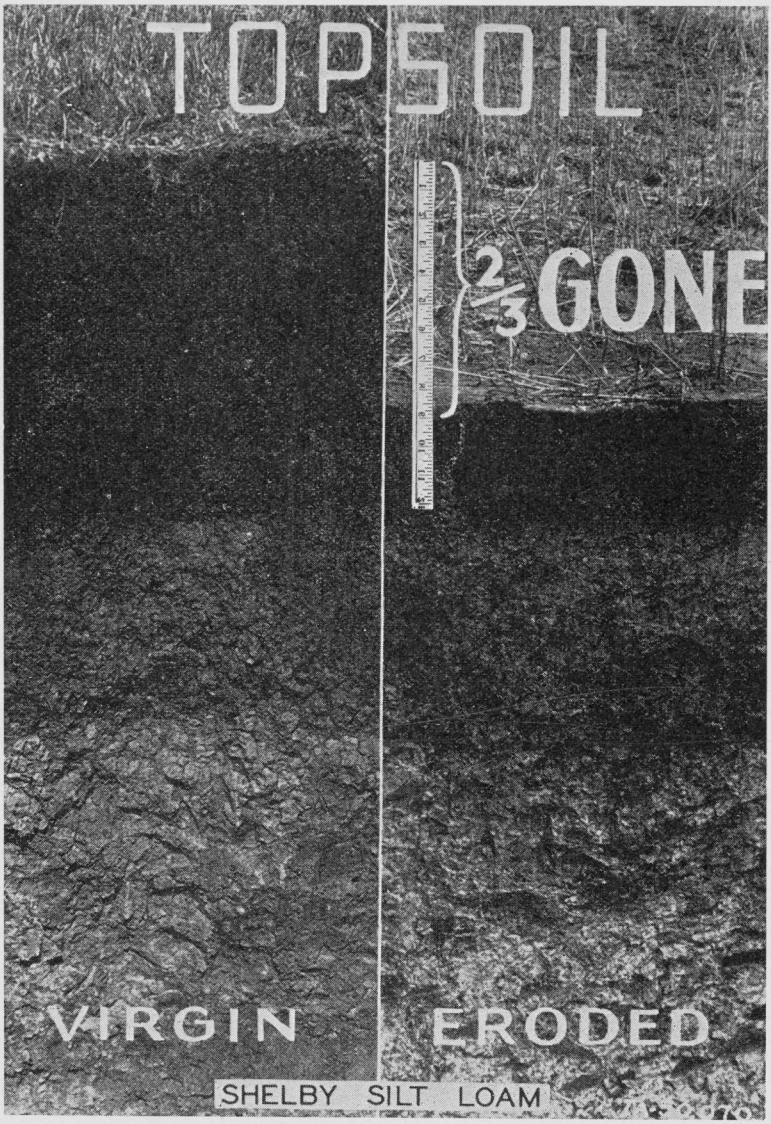

Fig. 7. Soil profiles of virgin and cultivated land.

but they had tried to do something about it. To control sheet erosion many farmers had attempted to adopt a rotation of crops suited to the topography of the land; to control gullying

Fig. 8. An example of sheet erosion in southern Iowa.

225 of 321 of the farmers stated that they had put brush in gullies, 210 had used manure or straw and 196 had established grassed waterways. The results achieved by these methods were evaluated by the farmers as shown in table 9.

Not one farmer reported that he had stopped sheet erosion and only 15 percent felt that they had achieved good results. By their attempts at gully control only 1.4 percent felt that they had stopped gully erosion, and 22 percent reported that the results of their earlier attempts were good. When asked why they had been unable to do more to control erosion in the past, the farmers reported as shown in table 10.

Most farmers were aware of the seriousness of erosion and desired to control it. The limiting factors were lack of finances,

TABLE 9. RESULTS ACHIEVED BY FARMERS IN ATTEMPTS TO CONTROL EROSION BEFORE THE SCS PROGRAM WAS ADOPTED.

Results	Sheet erosion		Gullying	
	No. farmers reporting	Percent	No. farmers reporting	Percent
Erosion stopped	0	——	4	1.4
Good results	42	15.4	63	22.3
Fair results	133	48.9	128	45.2
Poor results	62	22.8	55	19.4
Failure	35	12.9	33	11.7
Total	272	100.0	283	100.0

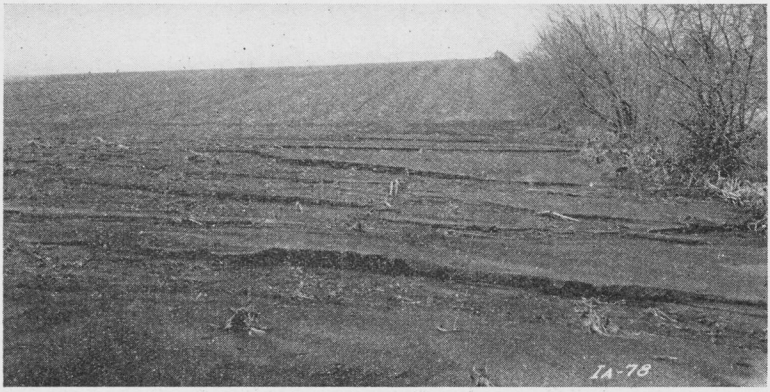

Fig. 9. Silt deposits resulting from sheet erosion in southern Iowa.

TABLE 10. REASONS WHY FARMERS DID NOT DO MORE TO CONTROL EROSION.

Reason	Number of farmers
1. Cost prohibitive	139
2. Did not know how	116
3. Did not get around to it	100
4. Tried but failed	92
5. Not aware of the seriousness of erosion	53
6. Not aware of the benefits of control	49
7. Did not know how long would be on farm	45

knowledge and initiative. One-third of the total group had tried and failed.

HOW THE SOIL CONSERVATION SERVICE HELPED COOPERATING FARMERS CONTROL EROSION ON THEIR FARMS

GENERAL PLAN OF ATTACKING THE PROBLEM OF EROSION

Figure 11 shows the four logical steps toward achieving erosion control.

1. A soil inventory is made by mapping the farm. Soil type, slope, degree of erosion and land use are all mapped. From this map can be seen the condition of the soil assets of the farm, and upon this knowledge the best-known soil treatments and practices needed to control erosion can be planned. A typical survey map is shown in fig. 12.

2. The second step, that of determining the cause of the condition, is not a simple one. For example, severe sheet erosion may be due to lack of cover; the planting of intertilled

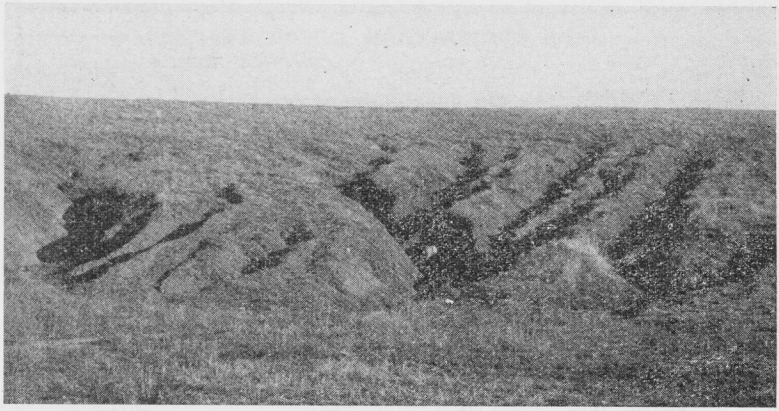

Fig. 10. An example of gullying in southern Iowa.

SOIL CONSERVATION PROGRAM
FOR REGION 5

I SOIL INVENTORY — TO SHOW (1) PHYSICAL CONDITION, (2) SOIL TREATMENTS AND PRACTICES NEEDED

II DETERMINE CAUSE of the CONDITION

III LAND USE PROGRAM

A. Permanent Vegetation
1. PERMANENT PASTURE & HAY
2. WOODLAND
3. WILDLIFE COVER

B. Crop Land in Rotation
1. CLEAN-TILLED CROPS
2. SMALL GRAINS
3. LEGUMES AND GRASSES

IV SUPPORTING CONSERVATION PRACTICES

A. Vegetative
1. CONTOUR STRIP CROPPING
2. CONTOUR BUFFER STRIPS
3. GRASSED WATERWAYS
4. COVER CROPS
5. REFORESTATION

B. Mechanical
1. CONTOUR TILLAGE
2. TERRACING
3. CONTOUR FURROWING
4. GULLY CONTROL
5. BASIN LISTING

CONSERVATION IS UTILIZATION OF RESOURCES WITHOUT WASTE

Fig. 11. Soil Conservation Service program for Region 5.

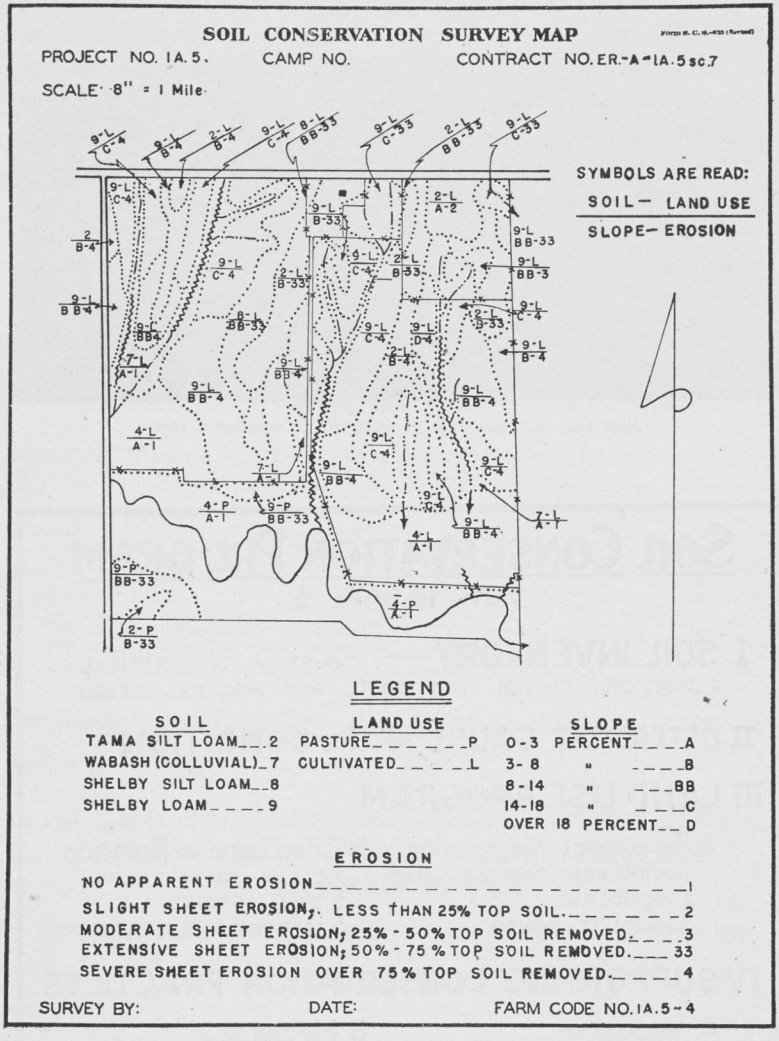

Fig. 12. A typical Soil Conservation Service conservation survey map.

crops up and downhill; it is strongly influenced by soil type and organic matter content which affects the water-holding capacity; it may be due to the steepness and length of the slope, or, as is more likely to be the case, it will result from a combination of these. Gullying results from excessive and too rapid runoff, especially when it is concentrated in dead fur-

rows, between rows of intertilled crops or in other depressions. The size of drainage area above a particular field is an important influence, as are also soil type and cover. Only after this analysis of causes is completed can an effective control program be developed.

3. The third step is the development of a sound land use program based upon 1 and 2 and a consideration of economic factors. The farm land is divided into two main classes: that which because of its condition must be kept in permanent vegetation (A) and that which may be used as cropland (B). After this first decision regarding land use is made, the type of permanent vegetation most suited to the particular conditions and the particular farm is considered; for the cropland the length of the rotation and most suitable crops must be decided in such a way that organic matter is maintained and the land covered during the heavy rainfall season. The decision as to the kind of crops which may safely be grown will also depend partly upon the types of practices which are adopted. For example, a larger part of the cropland might be left in corn if the land were terraced and strip cropped than if the same land were operated solely under a system of crop rotation with no supporting practices.

4. The last step consists of introducing supporting conservation practices designed to supplement the land use program. Under vegetative practices (A) are included the various methods of using vegetation to control the runoff of surface water. Contour strip cropping and buffer strips break up the fields so that no long slopes are in clean tilled crops or are bare at any one time in the year; any surface flow of water carrying silt from bare or clean tilled land is caught in a band of vegetation and the flow retarded so that much of the eroded silt is caught and held on the field. In addition, waterways are sown to grass, cover crops are used to prevent washing at the time of heavy rains and cut-over woodlots are reforested if necessary. The mechanical practices (B) include structures such as terraces, temporary and permanent dams, diversion ditches, contour furrows, etc., and cultivation practices such as contour tillage and basin listing. These are purely physical aids to help control the runoff of surface water.

This is a short summary of the general plan of attack on the problem and the relationships between various parts of the program. On each farm the number and kinds of practices vary as do the types and kinds of structures and also the rotations used on various soil types. Obviously, to achieve complete elimination of erosion the whole farm might have to be turned into pasture and forest, but this has not been the object of the SCS. Rather it has attempted to achieve the maximum control with no more changes in the land use plan and cropping system than were necessary to maintain the farm as a permanently productive unit.

The farm operator and the owner work with the SCS technicians in the formulation of the plan. The procedure varies somewhat in different watersheds, but usually the farmer applies to the local SCS office for assistance, and a technician visits him and discusses the needs of the farm and what might be done. After a complete survey the various technicians, the agronomist, the engineer, the soils man, the forester and the wildlife specialist all study the farm from their particular point of view. From the combined opinions of these men regarding what should be done, a complete and coordinated plan is developed and drawn up in form of a land use map (fig. 13). This plan is then discussed fully with the farmer, and in many cases modifications are made to suit his particular wishes, and his ability to carry the plan forward to completion. This plan is then signed in the form of a 5-year agreement with both the farmer and the Soil Conservation Service accepting definite responsibilities. In order to allow flexibility, amendments can be made from time to time if it becomes necessary to modify or expand the program on any particular farm.

The Soil Conservation Service does not undertake to render financial assistance to all cooperating farmers. The services of the technicians for surveying, analyzing and planning are, however, furnished free of charge. In some cases the SCS has helped to supply lime, fertilizer, legume and grass seed, construction materials and labor in order to facilitate the more rapid development of demonstrations. In these cases the contributions have been related to the individual farmer's ability

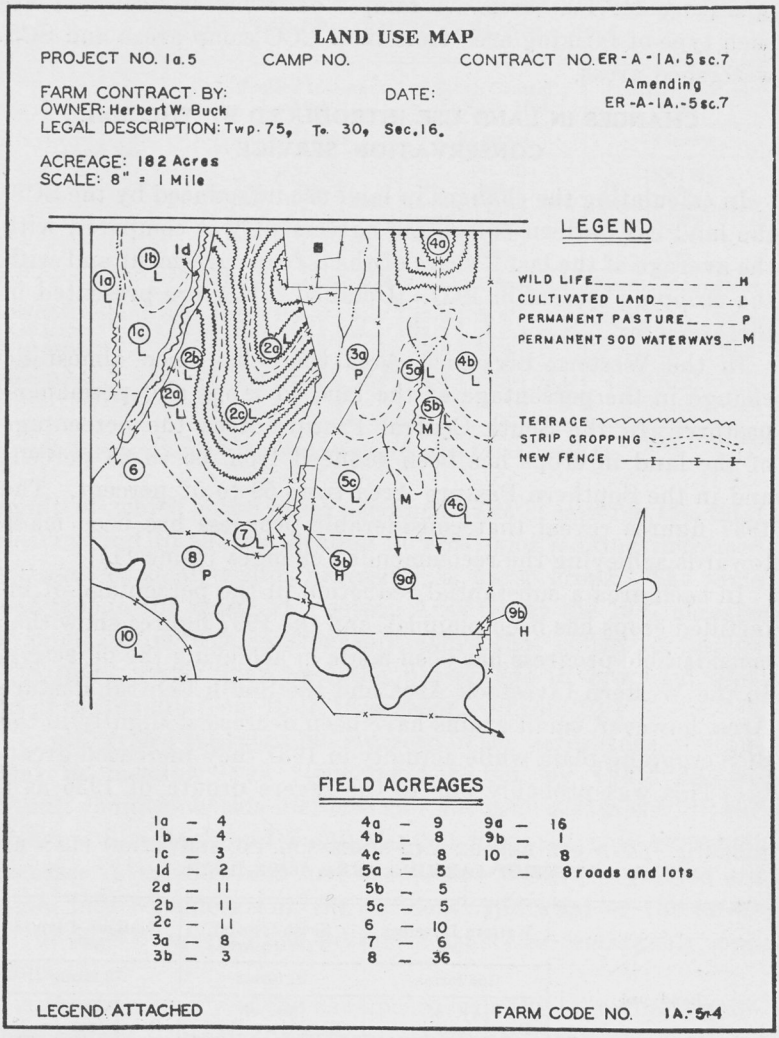

Fig. 13. Typical Soil Conservation Service land use map.

to contribute. The responsibilities which each accept are clearly stated in the agreement.

Up to June 30, 1938, there was a total of 2,838 farmers cooperating with the SCS in Iowa and a total area of 443,049 acres covered by cooperative agreements. In the three type-of-farming areas included in this study are 2,190 cooperating farmers

operating 348,612 acres. A sample of farms was selected for each type-of-farming area from both CCC camp areas and SCS watershed areas.

CHANGES IN LAND USE INTRODUCED BY THE SOIL CONSERVATION SERVICE

In calculating the changes in land use introduced by the SCS, the land use pattern before the agreement was compared with the average of the last 2 years of the 5-year agreement and with the cropping system in 1937. Detailed tables are presented in the appendix.

In the Western Livestock Area there has been almost no change in the percentage of the land in crops and permanent pasture. In the South Central Pasture Area the percentage of the land in crops has been reduced from 66 to 63 percent and in the Southern Pasture Area from 59 to 52 percent. The 1937 figures reveal that considerable progress has been made towards achieving the recommended changes (table 11).

In each area a substantial reduction in the percentage of intertilled crops has been planned, and the 1937 figures show that considerable progress has been made in achieving the objective. In the Western Livestock Area and the South Central Pasture Area, however, small grains have been decreased slightly in the SCS cropping plan, while actually in 1937 they increased greatly. This was probably due to the severe drouth of 1936 as a

TABLE 11. LAND USE BEFORE AND SINCE SOIL CONSERVATION PLAN BY TYPE-OF-FARMING AREA, IOWA, 1937.*

Land use	Western Livestock Area			South Central Pasture Area			Southern Pasture Area		
	153 farms			91 farms			73 farms		
	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937
	Percent of farm land			Percent of farm land			Percent of farm land		
Cropland	76.9	75.3	76.9	66.1	63.2	64.5	59.1	51.4	52.2
Permanent pasture	15.8	17.5	15.9	27.3	29.7	28.5	34.4	42.4	41.6
Other	7.3	7.2	7.2	6.6	7.1	7.0	6.5	6.2	6.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Acreage figures and percentage change are given in table 1 in the appendix.

TABLE 12. USE OF CROPLAND BEFORE AND SINCE SOIL CONSERVATION PLAN BY TYPE-OF-FARMING AREA, IOWA, 1937.*

Land use	Western Livestock Area			South Central Pasture Area			Southern Pasture Area		
	153 farms			91 farms			73 farms		
	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937	Before agreement	Av. of last 2 yrs. of SCS 5-year plan	1937
	Percent of farm land			Percent of farm land			Percent of farm land		
Intertilled crops	46.9	38.6	41.7	47.3	36.3	43.4	29.6	20.7	23.6
Small grains	28.3	26.1	35.7	27.5	24.8	35.3	10.0	18.0	24.0
Total meadow	24.6	35.3	22.6	22.4	38.8	21.1	47.8	61.2	52.2
Alfalfa	8.8	10.7	10.4	6.1	9.3	6.3	5.8	16.0	12.0
Sweet clover	5.6	11.7	4.1	4.3	17.2	4.9	4.2	2.1	1.5
Fallow and weeds	.2	.0	.0	2.8	.1	.2	12.6	.1	.2

*Acreage figures and percentage change are given in table 1 in the appendix.

result of which most grass seedings failed, causing the total meadowland to show a decline in 1937, and making increased acreages of small grains necessary as nurse crops. The same held true in the Southern Pasture Area where the 1937 acreage of small grains was considerably above that called for in the SCS plans which increased the percentage of cropland allocated to this use from 10 to 18 percent. (Table 12.)

In all areas a considerable increase in the percentage of cropland in meadow was recommended, but by 1937, due to drouth conditions, this increase had not been attained.[8] In the Western Livestock and South Central Pasture areas an actual decrease in meadowland had occurred. When these facts are taken into consideration, the farmers' appraisal of the effect of the SCS program upon productivity seems remarkably generous.

A short summary of the changes reveals the following significant points. In the Western Livestock Area the acreage of cropland is slightly reduced and the permanent pasture increased by a corresponding amount; a reduction of 19 percent in intertilled crops is planned, and by 1937 a reduction of 11 percent had been achieved. Small grains are to be decreased 10 percent according to the SCS plans but in 1937 were in-

[8] While these percentage figures are useful in presenting a summary of changes in land use, a much more detailed picture can be obtained by a brief review of the actual changes in acreages planned and attained by 1937. These figures are presented in table 1 of the appendix.

creased 26 percent in order to protect the seedings of meadowland. The plans call for an increase of 40 percent in meadowland with both alfalfa and sweet clover being increased; by 1937 the expansion in alfalfa had been largely attained but total meadow dropped.

In the South Central Pasture Area the plans call for a 4-percent reduction in cropland. By 1937 a reduction of 2.5 percent had been achieved. The SCS plans reduce the acreage of intertilled crops 27 percent, and by 1937 a reduction of 11 percent had been achieved. Small grains are reduced 14 percent in the plans but increased 25 percent in 1937. According to the plans meadowland is to be increased 66 percent, but in 1937 a decrease followed the drouth of 1936. In this area sweet clover is to be increased much more than is alfalfa and a considerable increase had been achieved by 1937.

When we turn to the Southern Pasture Area we find a very different picture. Cropland, under the SCS plans, has been reduced by 13 percent and permanent pasture increased. Not only has the cropland been reduced greatly but a much greater reduction has been made in intertilled crops; a total cut of 39 percent is planned and by 1937 a cut of 29 percent had been achieved. Small grains are increased 57 percent according to the plans but by 1937 had increased 113 percent. This is mainly due to the fact that the acreage before the agreements was extremely small, amounting to only 10 percent of the cropland, and to the seeding of large acreages for nurse crops. The acreage of meadowland has been increased 11 percent in the plans but showed a slight decline in 1937 due to the drouth and the fact that permanent pasture has been increased rapidly. In the legumes, alfalfa is replacing sweet clover to a very large extent.

In considering these changes in land use one is immediately faced with the problem of determining whether they are part of a general trend in the various areas resulting from the operation of the AAA or other factors. In order to obtain some indication of this, a sample of comparable farms not under any agreement with the SCS was selected and studied. In the sample of SCS cooperators between 80 and 90 percent also cooperated with AAA from 1934 to 1937. In the group of farms with no agreement with the SCS between 70 and 83 per-

TABLE 13. PERCENTAGE INCREASE OR DECREASE IN ACREAGES OF CROPS ON FARMS COOPERATING WITH THE SCS AND OTHERS, BY TYPE-OF-FARMING AREA, IOWA, 1937†

	Western Livestock Area		South Central Pasture Area		Southern Pasture Area	
	Farms coop. with SCS	Other	Farms coop. with SCS	Other	Farms coop. with SCS	Other
Number of farms	153	49	91	56	73	36
Permanent pasture	+ 1	*	+ 5	− 1	+21	+ 4
Total cropland	*	*	− 3	− 1	−12	− 4
Intertilled crops	−11	− 5	−11	+ 3	−29	−17
Small grains	+26	+31	+25	+33	+113	+49
Total meadow	− 8	−17	− 8	−29	− 4	−13

*Less than 1 percent change.

†The changes were measured from the year before the agreement to 1937 for the SCS cooperators and from 1933 to 1937 for other farms.

cent of the operators cooperated with the AAA. When the changes in land use between 1933 and 1937 on these latter farms are analyzed by type-of-farming area we obtain the comparison shown in table 13.

From these figures it seems safe to conclude that on farms not under agreement with the SCS intertilled crops have not been reduced as much as on the farms of cooperators, that the reduction in meadowland was much greater and that permanent pasture was not increased as greatly as it was on the cooperating farms. A comparison of the land use by these two groups for the year 1937 is summarized in table 2 of the appendix.

This table shows that in every area the farms cooperating with the SCS show a smaller percentage of the cropland in intertilled crops and a larger percentage in meadow and legumes than the farms not under agreement. When it is recalled that this is only the 1937 crop acreages and that the average of the last 2 years of the 5-year plans includes further reductions of intertilled crops and further increases in meadow and legumes the importance of these changes can be more clearly realized.

STRUCTURES AND PRACTICES INTRODUCED ON FARMS COOPERATING WITH THE SOIL CONSERVATION SERVICE

Tables 3, 4 and 5 of the appendix summarize the most common practices and structures introduced by the SCS. The fig-

ures for the original contract and the various amendments have been kept separate because of the important part that amendments have played in building up a complete program. In some cases four amendments were made; three were quite common, and only a very few agreements had none. A study of these amendments shows that in the case of the less common structures and practices, such as terracing, contour farming, strip cropping and diversion ditches, more were accepted in the amendments than in the original agreement. The farmer has not been forced to accept practices or structures, the value of which he questioned, but has signed an agreement which included only those things which he was sure he could handle and which he felt were needed; then, as he became more experienced in the technique of soil conservation, he accepted a more complete program. In the light of the difficulties which may be encountered in trying to introduce a complete program in too short a time, this more gradual approach appears to have been wise. However, as the program became better established the policy of making the original agreement much more complete has become possible, and this has the advantage of shortening the period of readjustment and harmonizing all developments. With the organization of soil conservation districts the drafting of complete plans, which provide for the attainment of the objectives over a period of years, would appear desirable.

In the Southern Pasture Area a much larger percentage of the farms have been terraced than in the other two areas; temporary dams in this area averaged 28 per farm as compared to 10 and 19 in the other two. On the other hand, contour farming and strip cropping have been introduced on more farms in the Western Livestock and South Central Pasture areas. In short, these figures reveal a close similarity between the treatments in the Western Livestock and South Central Pasture areas, with wide differences between these areas and the Southern Pasture Area. However, these differences are quite in harmony with the differences revealed in the analysis of changes in land use and can be related to the fact that erosion in the section of the Southern Pasture Area included in the study is more serious than in the other areas. The more drastic changes in land use, the greater number of dams needed and

the larger number of fields which have to be terraced, indicate the rapidly increasing cost of controlling erosion when it is not checked before it has gone too far. When considerable topsoil is left and gullying has not become serious, erosion control can be achieved under a system of land use which does not involve drastic reductions in acreages of cropland or intertilled crops, by the practices of contour farming and strip cropping with only a few of the longer slopes needing terraces and by the use of a few temporary dams. When all the topsoil has gone and gullying is serious then land has to be retired to permanent pasture or woodland, intertilled crops may be safely grown only on small areas, much of the land has to be terraced and numerous dams erected to control the gullies. On many of the farms in the section studied the more moderate program is all that is needed at present; in another 10 to 25 years erosion, if not checked, may have progressed so far that only drastic treatment will control it, and as the costs of control increases the ability of the land to bear these costs declines.

EFFECT OF THE SOIL CONSERVATION SERVICE PROGRAM UPON THE LIVESTOCK SYSTEM

USE OF PASTURE

Many farmers in the area stated that during the war period much land which had been kept as pasture or meadow was plowed up in order to increase the production of grain crops. The present trend toward reduced acreages of intertilled crops under the SCS program partly represents a return to the land use pattern as it was before the war. However, we do not have any accurate records of the land use by years prior to 1923, and this must remain a matter of conjecture.

TABLE 14. MONTHS IN WHICH PASTURE LAND WAS USUALLY OVERGRAZED, BY TYPE-OF-FARMING AREA, IOWA.

Area	Number of farmers reporting overgrazing							
	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Western Livestock	4	5	10	49	56	33	6	2
South Central Pasture	0	0	1	23	27	18	0	0
Southern Pasture	7	9	6	18	27	12	3	3
Total	11	14	17	90	110	63	9	5

Present pasture was sufficient for the present stock on 68 percent of the farms. In other words, approximately one-third of the farmers cooperating with SCS felt that in 1937 they were still deficient in pasture lands. Two-fifths of the farmers said that their pasture was usually overgrazed. (Table 14.)

Overgrazing is most serious during July, August and September. Many farmers use supplementary pasture, and table 15 shows that the percentage of farmers reporting the use of supplementary pasture varies inversely with the percentage of the farm in permanent pasture.

TABLE 15. PERCENTAGE OF FARMERS USING SUPPLEMENTARY PASTURE AND PERCENTAGE OF FARM LAND IN PERMANENT PASTURE, BY TYPE-OF-FARMING AREA, IOWA, 1937.

Area	Percent of farmers using supplementary pasture	Percent of farm land in permanent pasture
Western Livestock	82.8	16.8
South Central Pasture	70.9	28.5
Southern Pasture	46.7	41.6

Rye was the most common supplementary pasture crop with 140 farmers reporting its use; next was sweet clover reported by 124 farmers, while 97 used grass and clover, 17 alfalfa and 22 other meadow crops. Sudan grass was reported by 78 farmers and oats by 44.

Three-fourths of the farmers stated that the SCS program had increased the quantity of roughage produced on their farms, and the opinions of the cooperating farmers were obtained as to how this increase in roughage would affect the general farming system.

Two-thirds stated that they expected to plow under part of the increase in roughage as green manure. In the light of the extensive recognition of overgrazing and the wide-spread use of grass and legume meadows as supplementary pasture, it would seem probable that part of the planned increase in meadowlands can be used to advantage to reduce the pressure on the permanent pasture. This in turn would permit more of the small grains to be harvested for winter feed which could, to some extent, compensate for the loss in corn acreage. The improvement of pastures and rotation grazing might considerably increase the carrying capacity of the present pasture.

The increased use of green manure should have a beneficial effect upon the soil and lead to an increase in yields of grain crops, which would also tend to compensate for the reduction in grain acreage.

USE OF CONCENTRATES AND ROUGHAGE

Regarding changes in feeding practices or rations there appeared to be only a slight indication that, on the whole, less corn would be fed. Only 25 percent of the farmers were planning to reduce the amount of corn fed, and this was partially offset by 12 percent who planned to increase this item. Almost 30 percent of the farmers intended to increase their use of small grains for feeding purposes, while only 8 percent expected to decrease the amount of small grain fed. The largest change was in the use of forage and hay, with almost 60 percent of the farmers planning to feed more and only 3 percent planning a reduction. About 48 percent of the farmers expected to use more pasture, and almost 25 percent planned to increase their use of protein supplements, while only 10 percent planned a reduction. The complete figures by type-of-farming areas are given in table 6 of the appendix.

Regarding their purchases of feed, slightly over half of the farmers stated that they did not expect to make any changes, and the majority of those anticipating changes indicated that they expected to increase their purchases of corn and commercial feeds and decrease their purchases of small grains.

In general, there appears to be no sweeping changes which apply to all farms. The increase in roughage will be used to reduce the overgrazing of pastures or plowed under for green manure, or the amount fed in relationship to other feeds will be increased. Slightly less corn will be fed, but this is partly compensated for by the increased use of small grains. The use of forage will be increased and slightly more protein supplements used.

NUMBERS AND KINDS OF LIVESTOCK FED

The reduction in the acreage of intertilled crops (largely corn), changes in the acreage of small grains, and increases in meadow and permanent pasture may affect the livestock system

in several ways. Methods of feeding may be revised, purchases of supplementary feeds may be changed, the quantities and kinds of livestock fed may be varied, or, more probably, some combination of all of these possible adjustments will result. An ever-present difficulty in attempting to estimate the probable changes in a livestock system attributable to a change in land use arises from the fact that the numbers and kinds of livestock fed vary with price relationship, particularly in the case of hogs and feeder cattle. Other important factors affecting the livestock system on individual farms are tenancy, the condition of buildings and fences, available family labor, climatic conditions and marketing factors. Any attempts to measure the changes in livestock systems which may result from changes in land use are, therefore, fraught with danger. As Wilcox[9] has shown, dairying in Iowa has increased rapidly in spite of a decrease in hay and pasture, and the feeding of beef cattle is subject to great fluctuations which depend largely upon price relationships. Similarly, the corn-hog ratio affects the number and weights of hogs fed. Even if accurate historical figures were available, it appears difficult to state to what degree changes in livestock production are due to variations in land use and how much they are due to changes in price relationships.

On the farms studied there was no perceptible relationship between the percentage of land in intertilled crops and the total number of animal units per 100 acres within a single type-of-farming area. Indeed, within a given area, even the number of concentrate-consuming animal units (hogs and poultry) per 100 acres appears to vary independently of the percentage of land in intertilled crops. In other words, farms with large acreages of soil-depleting crops do not characteristically maintain large numbers of animal units per 100 acres.

However, when type-of-farming areas are compared we find that the Southern Pasture Area, which has a much smaller percentage of land in intertilled crops than the other two areas, feeds fewer concentrate-consuming animal units per 100 acres (see tables 7 and 8 of the appendix).

[9] See Wilcox, Walter W. Livestock production in Iowa as related to hay and pasture. Iowa Agr. Exp. Sta., Bul. 361. 1937.

There is, as would be expected, a distinct positive relationship between the amount of feed purchased or sold and the number of livestock, both concentrate and roughage-consuming, maintained per 100 acres. Nevertheless, there is a very wide variation in the number of animal units maintained per 100 acres by operators making essentially the same per acre expenditures for feed. In the pasture areas there is a slight though distinct tendency for the total animal units per 100 acres to decrease with the increasing size of the farm. This is particularly true of the roughage-consuming animal units. Only in the South Central Pasture Area is there a decrease in concentrate-consuming animal units per 100 acres with increasing farm size. In the Western Livestock Area the size of the farm does not affect the total animal units per 100 acres. In view of these facts it appears that on individual farms the personal ability and preference of the operator, together with the factors previously mentioned, constitute the decisive factors affecting the livestock system.

In spite of these difficulties, however, it is essential that, as far as possible, some estimate of the effect of changes in land use on the livestock system be made. Farm management studies in Iowa have shown that a high farm income has been associated with a high production of corn and hogs; the fundamental problem is to determine whether the decrease in corn acreage will result in a smaller number of hogs being fed and a lower farm income. In attempting to find indications of the probable answer to this question a group of farms not cooperating with the SCS was studied. The cropping systems and livestock systems were analyzed and compared on the assumption that the price and personal factors would tend to affect both groups in the same way on the average. In selecting the sample, farm size, topography and degree of erosion were used as criteria to ensure a comparable group of farms being selected. The various kinds of livestock were then reduced to animal units and expressed as animal units per 100 acres. In the sample of farms cooperating with the SCS information regarding livestock was taken from farm records kept during 1937 or from field schedules filled in by an enumerator in consultation with the farmer. The information on farms which

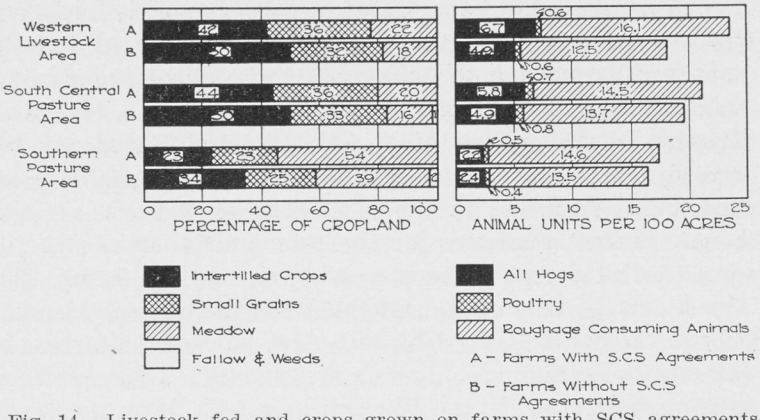

Fig. 14. Livestock fed and crops grown on farms with SCS agreements and on farms not under agreement. By type-of-farming area, Iowa, 1937.

had no SCS agreement was all collected on field schedules, as no records were kept. These results are tabulated by type-of-farming area and source of information in appendix table 7. In order to provide a basis of comparison the cropping system for 1937 on the two groups of farms is presented in appendix table 8. Both tables are summarized in graphic form in fig. 14.

This reveals that in the Western Livestock Area the farmers cooperating with the SCS were raising more concentrate-consuming animals and more roughage-consuming animals (in terms of animal units) per 100 acres than were the farmers who had not adopted the SCS program, in spite of the fact that those who had adopted the program had a much smaller percentage of their cropland in intertilled crops. The same statement is true for the South Central Pasture Area except for the fact that the differences are not quite as large. In the Southern Pasture Area the same statement also holds except that the farmers cooperating with the SCS and giving information on field schedules show slightly less concentrate-consuming animal units than are shown by those not cooperating. The combined figures from accounts and schedules, however, show very slightly less and these figures are so close that the reasonable statement to make for this area is that, in spite of the fact that the farmers cooperating with the SCS had less land in

crops and a much smaller percentage of the cropland in intertilled crops, they fed about the same number of concentrate-consuming animal units per 100 acres, and slightly more roughage-consuming animals, than did the farmers not cooperating with the SCS. This comparison further indicates that a smaller acreage of intertilled crops is not necessarily associated with a smaller production of concentrate-consuming animals; it also indicates that the farms with larger acreages of roughage feed more roughage-consuming animals.

Any change in the number or type of livestock fed on a particular farm may take place rather slowly as the farmer finds that he has too much or too little feed for his present stock. In order to see whether the farmers planned to change their livestock system they were asked to list any changes they expected to make during the next few years. The answers show that a large number of the farmers expected to increase the number of animals fed on their farms, while very few expected to reduce them. Appendix table 9 summarizes the replies by type-of-farming area. Part of this expected increase in livestock may be due to the fact that the drouths of 1934 and 1936 greatly reduced the livestock, and the increase will simply bring it back to normal; at the same time the figures do assure us that there is no expectation that livestock numbers will have to be reduced or that the changes in land use will result in a reduction of either concentrate or roughage-consuming animals on the farms.

The conclusions presented above, however, must be restricted to the case of a relatively small number of farms affected by changes in crop production. Obviously, if the changes were adopted generally, the same conclusions regarding the feeding of concentrate-consuming animals could not be drawn.

WILL IT PAY?

In considering the problem of whether the adoption of a soil conserving system of farming will pay there are three distinct aspects which may be considered. First is the social point of view. As erosion is controlled, the danger of floods, the silting of streams and reservoirs and the destruction of wildlife, as well as the losses from the direct depletion of the soil resources,

are reduced. In any complete appraisal of the Soil Conservation Program these social benefits from controlling erosion are of primary importance. Secondly, the probable effects on prices of farm commodities must be considered. What effects will shifts in land use and crop production which are necessary to insure proper conservation have upon the price relationships for the different products if such changes are adopted on a wide scale? Finally, the third aspect is the problem which faces each farmer as he considers the adoption of a soil conserving system of farming. What will it cost and how will it affect the income from his farm?

Though the second and third of these aspects of the problem are interrelated, this bulletin deals almost exclusively with the last named phase. The evaluation of whether it will pay the individual farmer to adopt soil conservation practices or not, assuming that no changes in relative prices take place, must include three separate estimates: First, the capital loss that will be avoided if the deterioration of the soil is curtailed; second, the capital cost of achieving control; and third, the effect of the changes upon the net income of the farm. These are briefly discussed in order to present the factors and problems which must be considered by any farmer when deciding whether soil conservation will pay or how far it is economically feasible for him to go in eliminating erosion.

Some estimate must be made of the rate at which erosion is taking place on the particular farm in question. In a recent bulletin[10] it has been shown that yields are more closely related to the depth of the surface soil than to soil type and that as the surface soil becomes shallower yields are reduced. Since the capital value of a farm is in a large degree dependent upon its productivity, any impairment of that productivity means a reduction in the capital value of the farm. Where the history of an area is known, a comparison of the present soil profile with the profile of a sample of virgin soil allows estimates to be made of the percentage of the soil which has been removed since the land was first farmed. The conservation surveys made by the SCS give this information in detail. Other visible indi-

[10] Murray, Wm. G., Engelhorn, A. J. and Griffin, R. A. Yield tests and land valuation. Iowa Agr. Exp. Sta., Res. Bul. 252.

cations of the seriousness of erosion are gullying, the appearance of light colored patches on fields indicating that most of the surface soil has been removed, the silting of drainage ways, a reduction in the resistance of crops to drouth and reduced yields.

Where a considerable depth of surface soil is left there may be little loss in productivity for many years even under a distinctly exploitative system of farming, and continued exploitation may be the most economical system to use from the individual farmer's point of view. This course, however, may be harmful to other groups in society in that damage to other property may result. Where the soil is shallow or gullying is serious, continued exploitation may mean that in a few years the land will become wasteland and have no economic value, being too poor and gullied to allow reforestation to pay. In many of the areas studied, land values are already extremely low. In certain counties in southern Iowa, for example, land values declined 51 percent from 1910 to 1935, while the decline for the state as a whole was only 25 percent.

To reduce the rate of damage by erosion to a dollar and cents figure is difficult, and yet some estimate must be made if any financial statement as to whether soil conservation pays is to be attempted. Each farm will have a different figure depending upon the type of cropping system it now has, the depth of surface soil left, the type of subsoil, topography and the rate at which productivity is being reduced. If it is assumed that the productivity of the land is being reduced at the rate of 1 percent per year, and this appears to be a very conservative figure for the area under consideration as was indicated in this bulletin (p. 132), then land worth $100 an acre would lose $1 a year in capital value, and the annual capital loss on a 200-acre farm would be $200. If the present value of the farm is only $50 per acre then the annual capital loss on a 200-acre farm would be $100. If the rate of reduction of productivity were 2 percent per year these figures would be doubled in each case.[11] On many farms the adoption of a soil conserving system of farming may not only prevent further capital loss but may in-

[11] These figures are purely illustrative for the general line of reasoning. The actual estimation of capital losses is a complex and difficult problem involving a separate analysis of each field.

crease capital values by making the farm more productive than it now is. In any case this estimate must be calculated for each individual farm. As was shown on p. 124 of this bulletin, most farmers cooperating with the SCS believe that the value of their farms has been increased by the program.

The next estimate to be made in answering the question "Will it pay?" is one of costs. These may be divided into capital expenditures which will not be frequently repeated and upkeep or annual costs which will become a part of the annual costs of production. The capital costs vary for each farm and depend upon the practices and structures needed to control erosion. The cost of terracing varies not only with the efficiency of the operator and equipment but also with the soil type, the slope and the length of the terrace; the cost of dams varies greatly, depending upon whether they are temporary or permanent; on some farms fences may have to be moved while on others the present field system will fit into the program. Quite accurate estimates of these costs are made by the technical staff of the SCS and, as soil conservation districts are formed, technicians capable of making these estimates will be available over larger areas.

The third consideration in making a financial appraisal is the effect of changes in the cropping system upon the farm organization, costs of production and income. The total labor requirements and seasonal distribution may be modified. The ratio of concentrate and roughage feeds produced may be changed as well as the total feed units produced. Longer rotations, increases in the use of barnyard and green manure, with the resulting increase in organic matter and water-holding capacity of the soil, make increased yields an important factor. This shift in the production of feed units may affect the feeding rations, the amount and type of feed purchased or the type of stock fed. Again it must be emphasized that individual preferences, abilities, price relationships and size of farm are important factors affecting the livestock system. In more detail the questions the farmer must answer are:

1. How will the new plan affect labor requirements? Will it require more hired labor or is my own family labor sufficient to cover any increased demands?

2. What changes will be made in the production of roughage and concentrate feed units?

3. Can I effectively utilize the feed units produced under a soil conserving system with my present livestock by adjusting my feeding practices?

4. Can I replace any loss in the production of concentrates by purchases, and will this added expense be offset by an increase in the number of animals which can be fed on the increase in roughage?

5. Can I better afford to achieve a new balance by increasing my roughage-consuming animals and reducing my concentrate-consuming animals with the price ratio between the two types as it is?

It is only as these questions are worked out on each farm that any estimate of the effect of the program on farm income can be made.

When these three estimates have been made a balance sheet for each individual farm can be prepared; the elimination of the annual capital loss can be balanced against the interest on the capital outlay necessary to prevent the loss taking place, and a final evaluation made by adding or subtracting the estimated increase of decrease in farm income.

The preliminary analysis presented here indicates that farmers believe soil conservation has made their farms more productive and increased the value of their land, and that the practices initiated will be continued. The livestock system does not appear to have been materially changed although the rations fed have been varied somewhat. There is no indication that the number of hogs raised has been reduced, while the number of roughage-consuming animals appears to have been increased.

In the light of these facts, the question immediately arises, why did farmers not adopt a soil conserving system of farming before the damage from erosion became so serious? In many instances, admittedly, exploitation has been the most economic course of action, but in the areas studied this does not appear to be the case at present. Even when conservation is the most economic course, lack of information regarding control measures, the persistence of customary methods of farming, diffi-

culties in adjusting farm size, lack of capital, indebtedness, price fluctuations, high and rigid fixed charges, tenancy and certain social factors all play their part as resistances to the changes necessary to establish a permanent and more profitable agricultural system. The evaluation of the importance of these resistances and determination of the methods by which they may be overcome is but a part of the problem of introducing soil conservation over the wide areas in which it is needed.

APPENDIX

TABLE 1. CHANGES IN ACREAGES OF VARIOUS CROPS INTRODUCED BY SCS, AND ACHIEVEMENT BY 1937, BY TYPE-OF-FARMING AREAS, IOWA.

	Before agreement (acres)	Av. of last 2 yrs. of SCS 5-year plan	Percent change	1937 acres	Percent change
Western Livestock Area—153 farms, 27,646.5 acres					
Total cropland	21,252.0	20,815.8	− 2.1	21,250.6	− .0
Intertilled crops	9,958.9	8,028.1	− 19.4	8,852.4	− 11.1
Small grains	6,017.4	5,429.1	− 9.8	7,589.8	+ 26.1
Total meadow	5,233.2	7,351.1	+ 40.5	4,800.9	− 8.3
Alfalfa	1,871.1	2,234.5	+ 19.4	2,215.0	+ 18.4
Sweet clover	1,195.8	2,427.6	+103.0	873.7	− 26.9
Fallow and weeds	42.5	7.5	− 82.4	7.5	− 82.4
Permanent pasture	4,357.7	4,826.6	+ 10.7	4,409.3	+ 1.2
Homestead, roads, misc.	2,036.8	2,004.1	− 1.6	1,986.6	− 2.5
South Central Pasture Area—91 farms, 15,146.0 acres					
Total cropland	10,005.2	9,567.7	− 4.4	9,759.8	− 2.5
Intertilled crops	4,733.2	3,472.4	− 26.6	4,235.7	− 10.5
Small grains	2,753.8	2,379.0	− 13.6	3,446.1	+ 25.1
Total meadow	2,236.7	3,710.8	+ 65.9	2,055.5	− 8.1
Alfalfa	613.6	888.4	+ 44.8	617.1	+ 0.6
Sweet clover	425.6	1,649.9	+287.7	480.3	+ 12.9
Fallow and weeds	281.5	5.5	− 98.0	22.5	− 92.0
Permanent pasture	4,136.2	4,506.3	+ 8.9	4,321.1	+ 4.5
Homestead, roads, misc.	1,004.6	1,072.0	+ 6.7	1,065.1	+ 6.0
Southern Pasture Area—73 farms, 13,918 acres					
Total cropland	8,221.9	7,148.9	− 13.1	7,258.3	− 11.7
Intertilled crops	2,430.0	1,475.6	− 39.3	1,716.7	− 29.4
Small grains	816.9	1,285.6	+ 57.4	1,740.2	+113.0
Total meadow	3,934.5	4,377.7	+ 11.3	3,788.3	− 3.7
Alfalfa	482.1	1,143.6	+137.2	846.5	+ 75.4
Sweet clover	350.5	150.0	− 57.2	113.0	− 67.8
Fallow and weeds	1,040.5	10.0	− 99.0	13.0	− 98.8
Permanent pasture	4,791.2	5,903.5	+ 23.2	5,794.0	+ 20.9
Homestead, roads, misc.	904.9	865.6	− 4.4	868.1	− 4.1

TABLE 2. LAND USE ON FARMS COOPERATING WITH THE SCS AND OTHERS, BY TYPE-OF-FARMING AREA, IOWA, 1937.

	Western Livestock Area		South Central Pasture Area		Southern Pasture Area	
	Farms coop. with SCS	Other	Farms coop. with SCS	Other	Farms coop. with SCS	Other
Number of farms	153	49	91	56	73	47
Total acreage	27,646.5	9,616.0	15,146.0	9,490.0	13,918.0	9,850.0
Percent of						
Farm in cropland	76.9	76.0	64.5	63.9	52.2	54.0
Farm in permanent pasture	15.9	17.1	28.5	30.6	41.6	39.7
Farm in homestead and misc.	7.2	6.9	7.0	5.5	6.2	6.3
Cropland in intertilled crops	41.7	49.1	43.4	48.8	23.6	33.7
Cropland in small grains	35.7	32.2	35.3	33.2	24.0	25.2
Cropland in meadow	22.6	18.7	21.1	16.8	52.2	38.6
Cropland in alfalfa	10.4	7.4	6.3	5.6	12.0	5.4
Cropland in sweet clover	4.1	2.6	4.9	.6	1.5	2.0
Cropland in fallow or weeds	.0	.0	.2	1.2	.2	2.5

TABLE 3. STRUCTURES AND PRACTICES INTRODUCED BY THE SCS IN THE WESTERN LIVESTOCK AREA, IOWA, 1937.

Structure or practice	Introduced in the			Number of farms using each	Percent of 154 farms cooperating	Average per farm using each
	Original agreement	Amendments	Total			
Terraces (acres)	253.5	662.0	915.5	54	35.1	17.0
Grassed waterways (acres)	650.5	295.9	946.4	104	67.5	9.1
Dams temporary (no.)	1,340.0	405.0	1,745.0	93	60.4	18.8
Dams permanent (no.)	64.0	30.0	94.0	48	31.2	2.0
Sloping banks (sq. yds.)	219,581.0	0.0	219,581.0	49	31.8	4,481.2
Game shelters (no.)	119.4	0.0	119.4	9	5.8	13.3
Tree plantings (acres)	158.4	62.9	221.3	72	46.8	3.1
Limed (acres)	1,324.4	1,899.0	3,223.4	87	56.5	37.1
Fertilized (acres)	368.6	308.7	677.3	62	40.3	10.9
Contour farmed (acres)	2,840.0	3,917.5	6,757.5	102	66.2	66.2
Strip cropped (acres)	1,257.0	2,236.0	3,493.0	54	35.1	64.7
Contour furrowed (acres)	109.0	218.0	327.0	15	9.7	21.8
Fences moved (rods)	2,781.0	5,216.0	7,997.0	39	25.3	205.1
New fences (rods)	7,968.0	4,058.0	12,026.0	66	42.9	182.2
Drainage area (acres)	4.0	0.0	4.0	1	.6	4.0
Diversion ditches (ft.)	1,956.0	5,395.0	7,351.0	11	7.1	668.2
Pasture improvements (acres)	14.5	39	53.5	6	3.9	9.0

TABLE 4. STRUCTURES AND PRACTICES INTRODUCED BY THE SCS IN THE SOUTH CENTRAL PASTURE AREA, IOWA, 1937.

Structure or practice	Introduced in the			Number of farms using each	Percent of 92 farms cooperating	Average per farm using each
	Original agreement	Amendments	Total			
Terraces (acres)	527.3	159.0	686.3	36	39.1	19.1
Grassed waterways (acres)	130.2	55.0	185.2	64	69.6	2.9
Dams temporary (no.)	329.0	65.0	394.0	40	43.5	9.9
Dams permanent (no.)	82.0	7.0	89.0	37	40.2	2.4
Sloping banks (sq. yds.)	9,783.0	0.0	9,783.0	20	21.7	489.2
Game shelters (no.)	13.0	10.0	23.0	12	13.0	1.9
Tree plantings (acres)	108.1	108.8	216.9	49	53.3	4.4
Limed (acres)	1,464.6	1,112.0	2,576.6	80	87.0	32.2
Fertilized (acres)	735.0	405.0	1,140.0	59	64.1	19.3
Contour farmed (acres)	249.0	639.0	888.0	33	35.9	26.9
Strip cropped (acres)	535.5	129.0	664.5	18	19.6	36.9
Contour furrowed (acres)	24.0	43.0	67.0	8	0.7	8.3
Fences moved (rods)	1,178.0	903.0	2,081.0	22	23.9	94.6
New fences (rods)	5,532.0	1,475.0	7,007.0	54	58.7	129.8
Drainage area (acres)	200.0	1.0	201.0	2	2.2	100.5
Diversion ditches (ft.)	2,402.0	3,385.0	5,787.0	11	12.0	526.1
Pastureimprovements(acres)	15.0	7.0	22.0	15	16.3	7.3

TABLE 5. STRUCTURES AND PRACTICES INTRODUCED BY THE SCS IN THE SOUTHERN PASTURE AREA, IOWA, 1937.

Structure or practice	Introduced in the			Number of farms using each	Percent of 75 farms cooperating	Average per farm using each
	Original agreement	Amendments	Total			
Terraces (acres)	286.6	422.1	708.7	39	52.0	18.2
Grassed waterways (acres)	111.2	65.0	176.2	58	77.3	3.0
Dams temporary (no.)	856.0	735.0	1,591.0	57	76.0	27.9
Dams permanent (no.)	15.0	41.0	56.0	29	38.7	2.1
Sloping banks (sq. yds.)	64,568.0	64,648.0	129,216.0	39	52.0	3,357.4
Game shelters (no.)	15.0	9.0	24.0	11	14.7	2.1
Tree plantings (acres)	88.9	90.9	179.8	45	60.0	3.9
Limed (acres)	946.5	1,749.5	2,696.0	72	96.0	37.4
Fertilized (acres)	808.0	1,784.0	2,592.0	63	84.0	41.1
Contour farmed (acres)	293.0	682.5	975.5	36	48.0	27.1
Strip cropped (acres)	112.0	168.4	280.4	12	16.0	23.3
Contour furrowed (acres)	14.0	16.5	30.5	8	10.7	3.8
Fences moved (rods)	90.0	80.0	170.0	4	5.3	42.5
New fences (rods)	2,245.0	1,793.0	4,038.0	34	45.3	118.7
Drainage area (acres)	141.0	0.0	141.0	5	6.7	28.2
Diversion ditches (ft.)	420.0	17,680.0	18,100.0	11	14.7	1,645.4
Pasture improvements(acres)	25.0	0.0	25.0	2	2.7	12.5

TABLE 6. CHANGES IN FEED RATIONS PLANNED BY FARMERS IN ORDER TO UTILIZE INCREASED ACREAGE, BY TYPE-OF-FARMING AREA, IOWA, 1937.

Feed and area	Number of farms	Increase		Decrease		No change	
		Number	Percent	Number	Percent	Number	Percent
Corn							
Western Livestock	145	19	13.1	40	27.6	86	59.3
South Central Pasture	88	11	12.5	14	15.9	63	71.6
Southern Pasture	75	8	10.7	24	32.0	43	57.3
Total	308	38	12.3	78	25.3	192	62.4
Small grains							
Western Livestock	145	42	29.0	8	5.5	95	65.5
South Central Pasture	88	25	28.4	5	5.7	58	65.9
Southern Pasture	75	23	30.7	12	16.0	40	53.3
Total	308	90	29.2	25	8.1	193	62.7
Forage and hay							
Western Livestock	145	98	67.6	6	4.1	41	28.3
South Central Pasture	88	33	37.5	3	3.4	52	59.1
Southern Pasture	75	52	69.3	0	0.0	23	30.7
Total	308	183	59.4	9	2.9	116	37.7
Pasture							
Western Livestock	145	79	54.5	3	2.1	63	43.4
South Central Pasture	88	23	26.1	2	2.3	63	71.6
Southern Pasture	75	45	60.0	0	0.0	30	40.0
Total	308	147	47.7	5	1.6	156	50.7
Protein supplements							
Western Livestock	145	36	24.8	15	10.3	94	64.8
South Central Pasture	88	7	8.0	9	10.2	72	81.8
Southern Pasture	75	32	42.7	6	8.0	37	49.3
Total	308	75	24.4	30	9.7	203	65.9

TABLE 7. ANIMAL UNITS PER 100 ACRES FED ON FARMS*, BY TYPE-OF-FARMING AREA AND SOURCE OF INFORMATION, IOWA, 1937.

Source of data	Farms cooperating with SCS			Farms not cooperating
	Farm accounts	Field schedules	Combined	Field schedules
Western Livestock Area				
Number of farms	47	83	130	81
Sows and boars	1.71	1.55	1.61	1.27
Pigs raised	5.39	4.89	5.08	3.61
Poultry	.62	.57	.59	.63
Total, concentrate-consuming	7.72	7.01	7.28	5.51
Milk cows	3.08	2.50	2.72	2.99
Beef cows	2.67	3.10	2.93	2.36
Feeders	5.56	4.65	4.99	2.77
Calves	2.24	1.10	1.54	1.16
Horses and mules	2.37	2.91	2.71	2.85
Sheep	1.22	1.21	1.21	.37
Total, roughage-consuming	17.14	15.48	16.10	12.50
Total animal units	24.86	22.49	23.38	18.01
South Central Pasture Area				
Number of farms	20	55	75	65
Sows and boars	1.67	1.35	1.43	1.09
Pigs raised	5.36	3.97	4.33	3.78
Poultry	.82	.59	.65	.81
Total, concentrate-consuming	7.85	5.91	6.41	5.68
Milk cows	3.75	3.34	3.45	3.34
Beef cows	2.10	2.35	2.28	1.62
Feeders	3.13	1.67	2.05	2.97
Calves	2.31	1.25	1.53	1.18
Horses and mules	2.52	2.86	2.77	2.94
Sheep	.84	3.01	2.44	1.65
Total, roughage-consuming	14.65	14.48	14.52	13.71
Total animal units	22.50	20.39	20.93	19.39
Southern Pasture Area				
Number of farms	27	32	59	47
Sows and boars	.51	.49	.50	.51
Pigs raised	1.82	1.43	1.65	1.90
Poultry	.41	.69	.53	.39
Total, concentrate-consuming	2.74	2.61	2.68	2.80
Milk cows	2.06	4.60	3.16	2.60
Beef cows	2.92	1.63	2.36	3.88
Feeders	2.30	1.26	1.85	1.62
Calves	1.68	1.13	1.44	.91
Horses and mules	1.62	3.23	2.32	2.14
Sheep	4.09	2.65	3.46	2.34
Total, roughage-consuming	14.67	14.50	14.59	13.49
Total animal units	17.41	17.11	17.27	16.29

*The conversion factors used in reducing livestock numbers to animal units were: One animal unit equals 1 horse or mule, 1 cow, 1.5 heifers or steers, 4 calves, 3.5 sows or gilts, 7.5 pigs, 7 sheep and 100 hens. For estimating the livestock numbers on farms with farm accounts the average of the opening and closing inventories was used for all breeding and work stock; the opening inventory plus purchases minus half the deaths was used for feeders; and the number weaned plus purchases minus half the deaths was used for pigs and lambs.

TABLE 8. LAND USE ON FARMS USED IN TABULATING ANIMAL UNITS PER 100 ACRES, BY TYPE-OF-FARMING AREA, IOWA, 1937.

	Western Livestock Area		South Central Pasture Area		Southern Pasture Area	
	Farms with SCS agreements	Farms without SCS agreements	Farms with SCS agreements	Farms without SCS agreements	Farms with SCS agreements	Farms without SCS agreements
Number of farms	130	81	75	65	59	47
Percent of farm in						
Cropland	76.7	76.3	65.4	64.4	51.6	54.3
Permanent pasture	16.1	17.2	28.1	30.0	41.9	39.6
Homestead, roads, m sc.	7.2	6.5	6.5	5.6	6.5	6.1
Percent of cropland in						
Intertilled crops	42.1	50.1	43.7	50.4	22.8	33.6
Small grains	35.7	31.7	36.3	32.5	22.9	25.1
Meadow	22.2	17.9	19.8	15.8	54.1	38.8
Alfalfa	9.7	8.2	5.5	5.5	11.3	5.5
Sweet clover	4.0	2.4	4.5	1.0	1.4	2.5
Fallow or weeds	0.0	0.3	0.2	1.3	0.2	2.4

TABLE 9. PERCENTAGE OF FARMERS EXPECTING TO INCREASE OR DECREASE THE LIVESTOCK FED ON THEIR FARMS, BY TYPE-OF-FARMING AREA, IOWA, 1937.

	Western Livestock Area			South Central Pasture Area			Southern Pasture Area		
	Inc.	Dec.	No change	Inc.	Dec.	No change	Inc.	Dec.	No change
	Percent of 152 farmers			Percent of 88 farmers			Percent of 71 farmers		
Dairy cows	27.0	4.6	68.4	48.9	5.7	45.4	39.4	7.1	53.5
Beef breeding stock	22.4	6.6	71.0	20.5	6.8	72.7	31.0	4.2	64.8
Dairy calves	16.5	2.6	80.9	21.6	2.3	76.1	29.6	2.8	67.6
Beef calves	24.4	2.6	73.0	12.5	6.8	80.7	29.6	4.2	66.2
Feeders	30.3	5.3	64.4	23.9	4.5	71.6	22.5	4.2	73.3
Horses and mules	17.1	6.6	76.3	26.1	8.0	65.9	19.7	14.1	66.2
Sheep	13.8	4.0	82.2	26.1	13.7	60.2	47.9	1.4	50.7
Hogs	43.4	5.3	51.3	51.1	10.2	38.7	35.2	7.1	57.7
Poultry	17.1	2.6	80.3	30.7	2.3	67.0	33.8	2.8	63.4